WQB "Wide Aperture Quad" for Main Injector

22 September 2005, 9:00 AM
IB2 conference room

Attendees: Linda Alsip, Bruce Brown, Weiren Chou, TJ Gardner, Hank Glass, Dave Harding, Ioanis Kourbanis, Bill Robotham, John Zweibohmer

Measurements

Hank showed the strength and harmonics measurements using the trim coil on WQB001. In the strength measurements the trim coil was powered from 0 to 28 A with the main coil off and at 1000 A. dGL/dI is as expected, including being a little bit less with the main coil at 0 A than it is with the main coil at 1000 A. A lengthy discussion ensued on the ease and usefulness of various additional measurements. Hank agreed to eventually repeat the measurements at 2800 A and 3600 A. The harmonics showed no surprises. The trim coil produces the same harmonics at the main coil.

With both the strength and harmonics coming out right, we are convinced that the trim coils are wired correctly. The anomalous inductances remain a mystery. We will ask Vladimir to run a model to see whether there might be a geometrical effect.

Hank showed reconstructed fields using harmonics data from measurements offset by ±0.98 inches as well as on center at several currents. There was modestly good agreement in the regions of overlap. The field definitely weakens from linear at high currents in the 50 mm neighborhood. There is pretty good agreement between the reconstructed field at the stretched wire measurements out to about 45 mm. Beyond that the unreported and unmeasured higher harmonics are probably contributing to the point of being significant. We see nothing to suggest that any harmonics other than the allowed ones (b6 (12-pole), b10 (20-pole), b14 (28-pole), b18 (36-pole), …) are important. Using a shorter Morgan coil would allow measuring at multiple positions and extracting higher moments (especially b14) by fitting a polynomial to lower moments as a function of position.

The data from the previous meeting comparing the WQB excitation cure to the average IQB curve was reviewed and strategy was discussed. The trim coils will clearly be required. The specified maximum trim current would correct the field at full operating current (150 GeV), but without much margin. The trim coil current will need to change sign in mid-ramp. Lengthening the core would reduce the maximum current needed, but increase the fractional correction at low currents (injection). AD will consider the possibilities.

The body-end separation has not yet been done above 1000 A. If we decide that we must modify the end field shape, which seems unlikely at the moment, the separation will be very useful. Otherwise it is primarily of academic interest.

Measurements will continue on WQB001

1. Harmonics as a function of transverse position with the shorter Main Ring quad Morgan coil to extract higher order harmonics.
2. Harmonics as a function longitudinal position to get the body-end separation.
3. Stretched wire scan at additional currents to confirm the adequacy of the field shape (after Joe DiMarco returns from IMMW)

Fabrication

WQB001 is at still MTF.

WQB002 has been retrofitted with the water-cooled bus and is ready for MTF.

WQB003 has been manifolded with the water-cooled bus and is ready for MTF.

WQB004 is ready for the final survey before welding.

WQB005 has potted coils glued in two quarter cores, with the other cores stacked and coils potted.

WQB006 all main coils are wound and two trim coils are wound.

WQB007 main coil winding has started.

Schedule

The question was raised of the last possible decision date for the shims. Assuming a February shutdown, we would want to budget all of January for measurements with a budget of two magnets per week for production measurements. That would ask for all the finishing work on the magnets – shim adjustment, beam tube flanges, inspections, paperwork – to be complete before the winter holidays. That means that a final decision must be made at the beginning of November to allow the finishing work to start in early November. [*Note added in proof: additional lead time will be required for procuring shims, so a decision is needed even sooner*.]

Next meeting will be 6 October 2005 at 9:00 in the Industrial Building 2 conference room.